Biological Results of the Strait of Georgia Spiny Dogfish (*Squalus suckleyi*) Longline Survey October 7-15, 2011

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BIOLOGICAL RESULTS OF THE STRAIT OF GEORGIA SPINY DOGFISH (*Squalus suckleyi*) LONGLINE SURVEY OCTOBER 7-15, 2011

by

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ABSTRACT

King, J.R., McPhie, R.P., and Morrison, P.R. 2012. Biological results of the Strait of Georgia spiny dogfish (*Squalus suckleyi*) longline survey October 7-15, 2011. Can. Tech. Rep. Fish. Aquat. Sci. 2975: iii + 24 p.

From October 7 to 15, 2011, a spiny dogfish (*Squalus suckleyi*) longline survey was conducted in the Strait of Georgia aboard the *CCGS Neocaligus*. Fishing occurred at nine sites selected in previous surveys to be representative of commercial fishing areas: Active Pass, Porlier Pass, Sturgeon Bank, French Creek, Cape Lazo, Cape Mudge, Grants Reef, Sinclair Bank and Epson Point. Four depth strata were fished during this survey: 56 to 110m, 111 to 165m, 166 to 220m and deeper than 220m. All captured spiny dogfish were measured for length, weight and sex. Other encountered species were enumerated.

RESUMÉ

King, J.R., McPhie, R.P., and Morrison, P.R. 2012. Biological results of the Strait of Georgia spiny dogfish (*Squalus suckleyi*) longline survey October 7-15, 2011. Can. Tech. Rep. Fish. Aquat. Sci. 2975: iii + 24 p.

Nous avons effectué un relevé de l'aiguillat commun (*Squalus suckleyi*) à la palangre du 7 au 15 octobre 2011 dans le détroit de Georgia à partir du NGCC *Neocaligus*. La pêche a été pratiquée à 10 sites choisis lors de relevés précédents comme représentatifs de zones de pêche commerciale : la passe Active, la passe Porlier, le banc Sturgeon, le ruisseau French, le cap Lazo, le cap Mudge, le récif Grants, le banc Sinclair et la pointe Epson. Quatre strates de profondeur ont été échantillonnées : 56 à 110 m, 111 à 165 m, 166 à 220 m et les profondeurs de plus de 220 m. Nous avons établi la longueur, le poids et le sexe de tous les aiguillats capturés; et dénombré les autres espèces capturées.

INTRODUCTION

Spiny dogfish in the north Pacific were identified as a separate species from Atlantic spiny dogfish (Ebert et al., 2010), and their name was officially changed from *Squalus acanthias* to *Squalus suckleyi* in 2011. Spiny dogfish were an important component of Canada's Pacific fishery from the late 1800s to the mid 1950s (Ketchen 1986). A resurgence in interest in the fishery led to an increase in catches in the late 1970s, particularly in the Strait of Georgia. Based on tagging studies (McFarlane and King 2002), the Strait of Georgia stock is considered to be discreet. The increase in fishing catches in the late 1970s prompted the initiation of an assessment program. As part of this study, longline surveys were conducted in the Strait of Georgia in 1986 and 1989 (McFarlane et al 2005a), 2005 (McFarlane et al. 2006) and 2008 (King and McFarlane 2009) to provide biological, catch and effort data for selected sites. A longline calibration survey was conducted in 2004 to account for catch rate changes that might have occurred in the commercial fishery due to a change from using J-hooks to using circle hooks (McFarlane et al. 2005b). This report provides catch and biological summary data for a fifth survey conducted in the Strait of Georgia from October 7-15, 2011. It is our intention to continue these surveys on a tri-annual basis in order to monitor the status of spiny dogfish in the Strait of Georgia.

METHODS

From October 7 to 15, 2011 the spiny dogfish longline survey was conducted onboard the *CCGS Neocaligus*.

In the previous four surveys, longline fishing occurred at ten sites throughout the Strait of Georgia that were selected to be representative of commercial fishing areas. Logistical constraints (i.e., reduced ship days) meant that only nine sites could be surveyed in 2011 (Figure 1). The nine sites were surveyed in all previous years, and were selected to provide even geographic coverage of the Strait of Georgia that remained consistent with the previous five surveys. The sites were located near Active Pass, Cape Lazo, Cape Mudge, Epson Point, French Creek, Grant Reef, Porlier Pass, Sinclair Bank and Sturgeon Bank (see Appendix 1 for positional data). The Hornby Island site, which was included in the previous four surveys, was omitted from this survey. In previous surveys, fishing gear was deployed at each site in five depth strata:

1. less than 56 m
2. 56 to 110m
3. 111 to 165m
4. 166 to 220m
5. greater than 220 m

Due to time constraints, this survey fished strata 2-4 only. Stratum 1 was omitted since it previously had the highest rockfish bycatch, and it was previously omitted at sites when bad weather curtailed fishing time. At each site the four depth strata were fished in random order. Once the vessel arrived at the pre-selected site the appropriate depth range was located and fishing proceeded along the depth contour.

Each longline set consisted of 2 groundlines (5/16 inch leaded copolym) with an anchored buoyline (3/8 inch polysteel) hooked on at each end. Model 72 snaps (3 cm in width; 13 cm in length), made from 3.2 mm stainless steel wire, were snapped onto the groundline about every 2 meters as the gear was set. Attached to the snap, crimped Perlon snap gangions 30 cm long were fitted with circle hooks. Size #14/0 Mustad circle hooks were used. Each hook was baited with a third of a 6 inch herring.

At each location the groundline was deployed with 300 baited hooks per set. This number of baited hooks is consistent with the 2008 survey, but is lower than the three surveys preceding 2008, which used 500 baited hooks per set (1986 and 1989) or 400 baited hooks per set (2005). Hook number in the 2008 and 2011 surveys was reduced due to high catch rates in the initial three surveys, and to reduce the number of hours required to sample the catch. Differences in catch rates were assessed in 2008 when four extra sets were conducted at French Creek with 400 baited hooks per set (King and McFarlane 2009).

The effective fishing time for each set was recorded as the time from when the first hook was deployed until the last main groundline anchor was onboard. In order to minimize bias in catch rates due to differences in effective fishing time, all longline sets were fished for approximately 2 hours. The target 2 hour fishing time was recorded as the time from when the last hook was deployed, until the first main groundline anchor was onboard. Catch per unit effort (CPUE) for a longline set was calculated as the total number of spiny dogfish caught per thousand hooks.

All fish, other than those lost at the surface, were removed from the hooks, identified to species and counted. All spiny dogfish lost at the surface were noted and included in the total catch numbers. All spiny dogfish and the two bluntnose sixgill sharks (*Hexanchus griseus*) that were brought on board were sampled and released; other species were identified and immediately released.

Length, weight and sex were recorded from all captured whole spiny dogfish. Length was measured (mm) as the total length of the fish; from the tip of the snout to the tip of the upper lobe of the caudal fin when it was directed downward in a straight line with the body. Weight was determined to the nearest 0.01 kg and sex was determined externally. Non-linear regression was used to estimate the weight-length relationship:
$W = aTL^b$,
where W = weight (g), TL = total length (mm), and a and b are estimated parameters. Differences between male and female weight-length relationships were tested with ANCOVA based on natural logarithmic linear regression models.

RESULTS

From October 7-15, 2011, 10,500 hooks were set over 35 sets at 9 sites (Table 1). At each site, 4 depth strata were fished, except for Sinclair Bank where only 3 strata were fished due to gale force winds that caused the last set (stratum 3) to not be deployed. The

mean effective fishing time was 167 minutes, and the mean fishing time was 120 minutes (Table 1). A total of 6,706 spiny dogfish were captured, including those lost at the surface (n=54) or those hooked but predated (Table 2). Fifty-eight of the captured dogfish were predated, which has not been recorded to have occurred on the previous surveys. The predated spiny dogfish had tooth marks on them, and two bluntnose sixgill sharks were captured on this survey both of which were predating spiny dogfish captured on the fishing gear. Longnose skate (*Raja rhina*), quillback rockfish (*Sebastes maliger*), yelloweye rockfish (*S. ruberrimus*) and Pacific cod (*Gadus macrocephelus*) were the most frequent bycatch encountered (Table 2).

CATCH PER UNIT EFFORT

CPUE comparison by depth strata

For males, the CPUE was highest in stratum 3 but variable among depths; for females, the CPUE increased by depth (Table 3). The CPUE for all spiny dogfish increased with increased depth (Table 3). Depth stratum 3 was not fished at Sinclair Bank due to inclement weather, so comparison of CPUE by location will be compromised given the differences in CPUE by depth.

CPUE comparison by site

Sinclair Bank Excluded – When Sinclair Bank is excluded from comparison and all four depth strata are used to calculate CPUE by locations, the mean CPUE for all spiny dogfish was 640 fish/1000 hooks (Table 1). The CPUE for male spiny dogfish was typically higher than for female spiny dogfish, and the mean CPUE by site for male and female spiny dogfish were 468 fish/1000 hooks and 160fish/1000 hooks respectively (Table 1). Total CPUE by site ranged from 575 (French Creek) to 773 (Cape Lazo) fish/1000 hooks. Sites with the highest dogfish CPUE were Cape Lazo, Active Pass and Epson Point. French Creek, Grants Reef, and Porlier Pass had the lowest CPUE. Male spiny dogfish CPUE was highest at Active Pass and Cape Lazo; female spiny dogfish CPUE was highest at Sinclair Bank and Grants Reef (Table 1).

Sinclair Bank Included -For the three depth strata common to all locations (strata 2, 4 and 5) the mean CPUE for all spiny dogfish was 630 fish/1000 hooks (Table 1). The CPUE for male spiny dogfish was typically higher than for female spiny dogfish, and the mean CPUE by site for male and female spiny dogfish were 322 fish/1000 hooks and 158 fish/1000 hooks respectively (Table 1). Total CPUE by site ranged from 552 (Grants Reef) to 783 (Cape Lazo) fish/1000 hooks. Sites with the highest dogfish CPUE were Cape Lazo, Active Pass and Epson Point. Grants Reef, Cape Mudge and Porlier Pass had the lowest CPUE. Male spiny dogfish CPUE was highest at Active Pass and Cape Lazo; female spiny dogfish CPUE was highest at Sinclair Bank and Epson Point (Table 1).

LENGTH AND WEIGHT FREQUENCY

Length and sex were recorded for 6,586 dogfish, of these 6,582 had recorded weights. Of the 58 predated dogfish, 10 dogfish were sampled for sex of which 2 could also be sampled for total length. Detailed spiny dogfish length frequency catch data for sex by fishing site and sex by depth strata is presented in Tables 4 and 5 and Figures 2 and 3.

A total of 1925 female and 4653 male spiny dogfish were measured for total length (Table 4). Male spiny dogfish ranged in size from 298-986 mm with a mean length of 739 mm (Table 5). Female spiny dogfish ranged in size from 490-1156 mm with a mean length of 713 mm (Table 5). Both female and male dogfish mean total length decreased with increased depth (Table 5). The mean total length for male dogfish was greater than that of female dogfish in all except the shallowest stratum (t-test: $t_{0.05,6569}=10.45$, $p<0.01$; Table 5). The smallest spiny dogfish was a male (298 mm) caught in depth stratum 3 at Active Pass; the largest was a female (1156 mm) caught in depth stratum 2, also at Active Pass (Table 5).

By depth and location, the distribution of total length for male spiny dogfish was more uniform across the size range than that of female spiny dogfish, which often had a skewed or bimodal distribution (Figures 2 and 3).

A total of 1924 female and 4658 male spiny dogfish were measured for weight. Male spiny dogfish ranged in size from 170-3310 g with a mean weight of 1507 g (Table 6). Female spiny dogfish ranged in size from 380-5770 g with a mean weight of 1567 g (Table 6). There was a significant difference in the weight-length relationship (Figure 4, Table 7) between male and female spiny dogfish (ANCOVA: $F=452.04$, d.f. = 2, $P < 0.0001$).

SEX DISTRIBUTION BY DEPTH STRATA AND SITE

Depth strata

For all of the nine sites combined in the Strait of Georgia, there was a larger proportion of male spiny dogfish caught in each depth strata (Figure 5). Female dogfish decreased in proportion from stratum 2 to stratum 3, after which, they were present in increasing proportion by depth (Figure 5).

Site

Seven of the nine sites had a larger proportion of male spiny dogfish ranging from 60% to 94% of the catch. At the remaining two sites, Epson Point and Sinclair Bank, female spiny dogfish proportions were 65% and 70% of the catch respectively (Figure 6).

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Table 1. Summary by fishing area of number of sets, mean effective fishing time, mean fishing time, number of hooks deployed, number of measured spiny dogfish, catch per unit effort (fish per 1000 hooks; CPUE) for all depth strata fished at a location and for three core depth strata that were fished at every location (56-110 m; 166-220 m; >220 m) from the October 7 to 15, 2011 Strait of Georgia spiny dogfish longline survey. Total spiny dogfish CPUE includes fish lost at surface or predated (for which sex may be unknown).

						CPUE					
						All depth strata			Three depth strata		
Location	Number of sets	Mean effective fishing time	Mean fishing time	Number of hooks	Number of spiny dogfish	Male	Female	Total	Male	Female	Total
Active Pass	4	163	121	1200	867	604	110	723	428	89	699
Cape Lazo	4	169	115	1200	927	657	100	773	503	70	783
Cape Mudge	4	163	120	1200	709	424	158	591	297	133	580
Epson Point	4	163	121	1200	805	228	428	671	160	313	648
French Creek	4	168	121	1200	690	423	148	575	318	121	594
Grants Reef	4	163	119	1200	699	343	228	583	225	176	552
Porlier Pass	4	177	120	1200	702	496	73	585	357	64	583
Sinclair Bank	3	179	129	900	567	--	--	--	184	432	632
Sturgeon Bank	4	158	119	1200	740	572	36	617	424	20	601
Total	35	167	120	10483	6706		Overall	640		Overall	630

Table 2. Number of fish caught by species during the October 2011 spiny dogfish longline survey. Recorded species include: spiny dogfish (*Squalus suckleyi*), bluntnose sixgill shark (*Hexanchus griseus*), big skate (*Raja binoculata*), longnose skate (*R. rhina*), Pacific cod (*Gadus macrocephelus*), Pacific hake (*Merluccius productus*), copper rockfish (*Sebastes caurinus*), greenstriped rockfish (*S. elongatus*), quillback rockfish (*S. maliger*), yelloweye rockfish (*S. ruberrimus*), sablefish (*Anoplopoma fimbria*), lingcod (*Ophiodon elongatus*), and Pacific halibut (*Hippoglossus stenolepis*). Spiny dogfish catch includes fish landed (and biologically sampled), fish lost at the surface and fish predated.

Set	Spiny dogfish	Sixgill shark	Big Skate	Longnose skate	Pacific cod	Pacific hake	Copper rockfish	Greenstriped rockfish	Quillback rockfish	Yelloweye rockfish	Sablefish	Lingcod	Pacific halibut
1	169	--	--	--	--	--	--	--	--	--	--	--	--
2	181	--	--	--	--	--	--	--	--	--	--	--	--
3	157	--	--	--	--	--	--	--	--	--	--	--	--
4	183	--	1	--	--	--	--	--	--	--	--	--	--
5	193	--	--	--	--	--	--	--	--	3	--	--	--
6	217	--	--	1	--	--	--	--	--	--	--	--	--
7	157	--	--	--	1	1	--	--	1	--	--	--	--
8	187	--	--	--	--	--	--	--	1	2	--	--	--
9	144	--	--	--	--	--	--	--	--	--	--	--	--
10	169	--	--	1	--	--	--	--	--	--	--	--	--
11	209	--	--	--	--	--	--	--	--	--	--	--	--
12	73	--	--	4	4	--	--	1	8	--	--	--	--
13	204	--	--	--	--	--	--	--	--	1	--	--	--
14	202	--	--	--	--	--	--	--	--	--	--	--	--
15	220	--	--	1	--	--	--	--	--	--	--	--	--
16	227	--	--	--	--	--	--	--	--	--	--	--	--
17	222	--	--	--	--	--	--	--	--	--	--	--	--
18	235	--	--	--	--	--	--	--	--	--	--	--	--
19	243	--	--	--	--	--	--	--	--	--	--	--	--
20	236	--	--	--	--	--	--	--	--	--	--	--	--
21	247	--	--	--	--	--	--	--	--	--	--	--	--
22	100	--	--	--	1	--	2	--	15	3	--	--	--
23	222	--	--	1	1	--	--	1	--	--	--	--	--
24	208	1	--	--	--	--	--	--	--	--	--	--	--
25	227	--	--	--	--	--	--	--	--	--	--	--	--
26	182	--	--	3	--	--	--	--	--	--	--	--	--

Table 2 continued. Number of fish caught by species during the October 2011 spiny dogfish longline survey. Recorded species include: spiny dogfish (*Squalus suckleyi*), bluntnose sixgill shark (*Hexanchus griseus*), big skate (*Raja binoculata*), longnose skate (*R. rhina*), Pacific cod (*Gadus macrocephelus*), Pacific hake (*Merluccius productus*), copper rockfish (*Sebastes caurinus*), greenstriped rockfish (*S. elongatus*), quillback rockfish (*S. maliger*), yelloweye rockfish (*S. ruberrimus*), sablefish (*Anoplopoma fimbria*), lingcod (*Ophiodon elongatus*), and Pacific halibut (*Hippoglossus stenolepis*). Spiny dogfish catch includes fish landed (and biologically sampled), fish lost at the surface and fish predated.

Set	Spiny dogfish	Sixgill shark	Big Skate	Longnose skate	Pacific cod	Pacific hake	Copper rockfish	Greenstriped rockfish	Quillback rockfish	Yelloweye rockfish	Sablefish	Lingcod	Pacific halibut
27	85	--	--	--	--	--	1	1	19	2	--	2	--
28	160	--	--	1	--	--	1	--	4	2	--	--	--
29	238	--	--	2	--	--	--	--	--	--	--	--	--
30	227	--	--	--	--	--	--	--	--	--	1	--	--
31	242	1	--	--	--	--	--	--	--	--	--	--	--
32	66	--	--	--	--	--	--	--	--	--	--	--	1
33	199	--	--	--	1	--	--	--	--	--	--	--	--
34	230	--	--	--	--	--	--	--	--	--	--	--	--
35	245	--	--	1	--	--	--	--	--	--	--	--	--
Total	6706	2	1	15	8	1	4	3	48	13	1	2	1

Table 3. Summary of CPUE (fish per 1000 hooks), mean effective fishing time (minutes), mean fishing time (minutes) and number of spiny dogfish captured by depth stratum from the October 7-15, 2011 Strait of Georgia spiny dogfish longline survey.

						Number of spiny dogfish				CPUE		
Depth stratum	Depth range (m)	Number of sets	Mean effective fishing time	Mean fishing time	Number of hooks	Males	Females	Unknown sex	Total	Males	Females	Total
2	56-110	9	164	121	2700	840	334	21	1195	311	124	443
3	111-165	8	163	120	2400	1240	353	18	1611	517	147	672
4	166-220	9	171	121	2700	1346	563	34	1943	499	209	720
5	>220	9	168	120	2700	1240	678	39	1957	462	252	729

Table 4. Spiny dogfish total length frequency data, by 50 mm length intervals, from the spiny dogfish longline survey conducted in the Strait of Georgia onboard the *CCGS Neocaligus*, October 7-15, 2011.

Length interval	Number of males	Number of females
250-299	1	0
300-349	0	0
350-399	1	0
400-449	1	0
450-499	3	3
500-549	62	89
550-599	185	241
600-649	367	389
650-699	580	341
700-749	1133	248
750-799	1383	163
800-849	740	128
850-899	174	113
900-949	28	110
950-999	2	52
1000-1049	0	35
1050-1099	0	10
1100-1149	0	2
1150-1199	0	1
Total	4660	1925

Table 5. Summary of minimum, maximum and mean total length (mm) data for spiny dogfish captured by depth stratum (See Figure 2 for sample sizes) from the October 7-15, 2011 Strait of Georgia spiny dogfish longline survey.

	Male spiny dogfish				Female spiny dogfish			
Depth Stratum	n	Minimum	Maximum	Mean	n	Minimum	Maximum	Mean
2	840	510	949	767	334	507	1156	847
3	1240	298	986	745	353	505	1100	736
4	1344	440	944	728	561	491	1105	669
5	1236	440	965	725	677	490	995	670

Table 6. Summary of minimum, maximum and mean total weight (g) data for spiny dogfish captured by depth stratum from the October 7-15, 2011 Strait of Georgia spiny dogfish longline survey.

	Male spiny dogfish				Female spiny dogfish			
Depth Stratum	n	Minimum	Maximum	Mean	n	Minimum	Maximum	Mean
2	840	420	2860	1643	334	430	5770	2680
3	1239	170	3000	1547	352	380	5510	1800
4	1344	380	3140	1452	561	390	5580	1206
5	1235	320	3310	1430	677	380	4270	1196

Table 7. Weight-length parameters estimates derived from the eqaution $W = aTL^b$ for male and female spiny dogfish caught in the October 7-15, 2011 Strait of Georgia spiny dogfish longline survey. R^2 is the square of correlation coefficient.

Sex	n	*a*	*b*	R^2
Male	4660	3.0×10^{-6}	3.021	0.93
Female	1925	5.0×10^{-7}	3.309	0.98

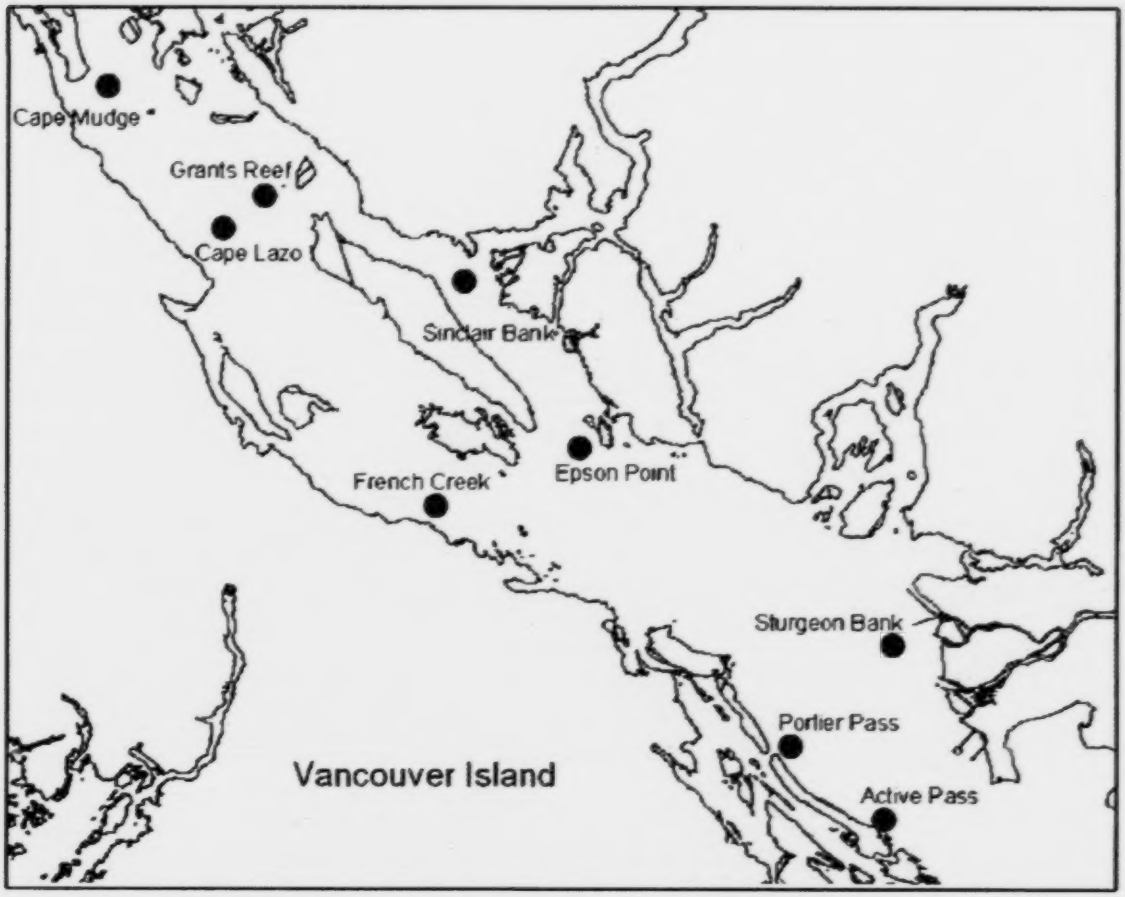


Figure 1. Set locations from the Strait of Georgia spiny dogfish longline survey conducted October 7-15, 2011. For detailed positional information see Appendix 1.

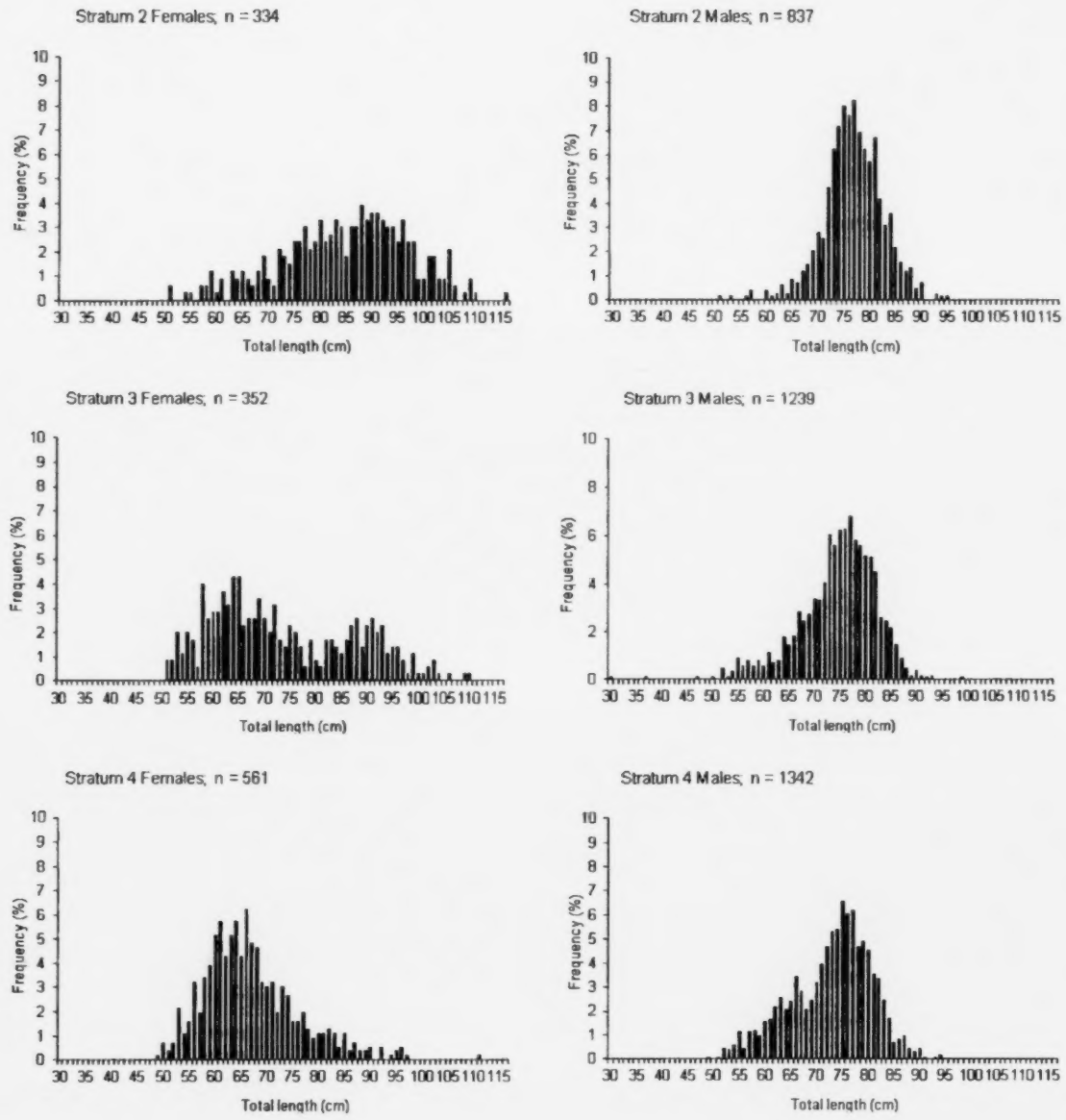

Stratum 2 Females; n = 334
Stratum 2 Males; n = 837
Stratum 3 Females; n = 352
Stratum 3 Males; n = 1239
Stratum 4 Females; n = 561
Stratum 4 Males; n = 1342
Frequency (%)
Total length (cm)

Figure 2. Spiny dogfish length frequency by sex and depth stratum (2: 56 to 110m, 3: 111 to 165m, 4: 166 to 220m and 5: deeper than 220m) from the October 7-15, 2011 Strait of Georgia spiny dogfish longline survey.

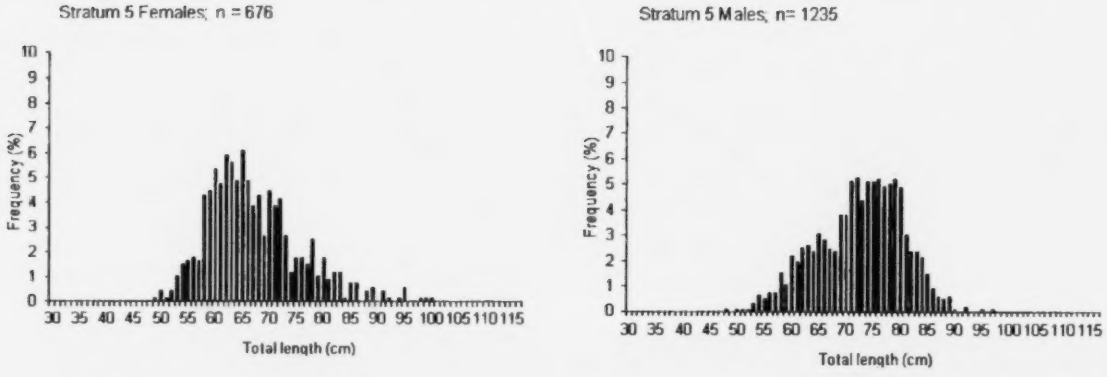


Figure 2 continued. Spiny dogfish length frequency by sex and depth stratum (2: 56 to 110m, 3: 111 to 165m, 4: 166 to 220m and 5: deeper than 220m) from the October 7-15, 2011 Strait of Georgia spiny dogfish longline survey.

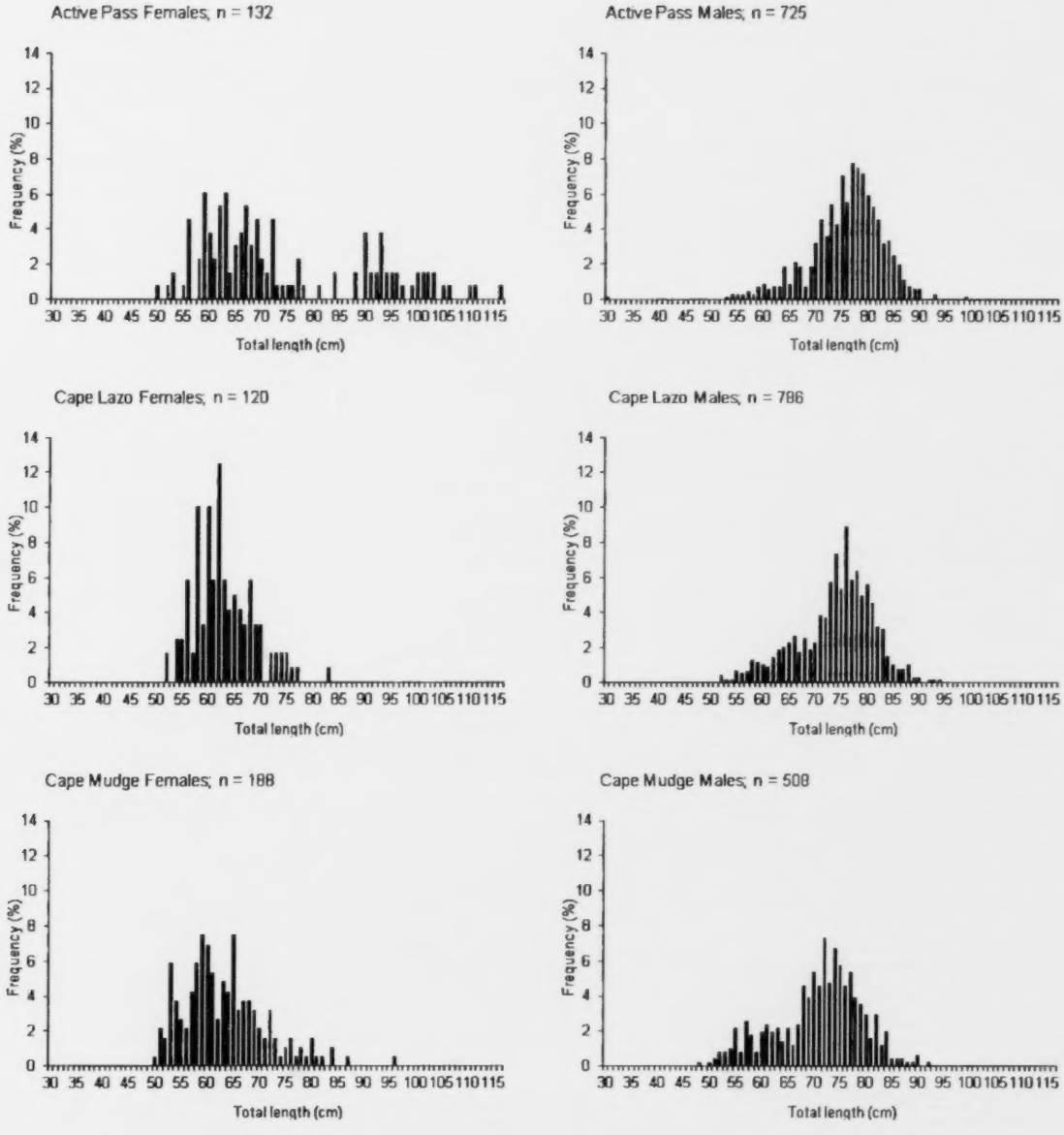

Active Pass Females; n = 132
Active Pass Males; n = 725
Cape Lazo Females; n = 120
Cape Lazo Males; n = 786
Cape Mudge Females; n = 188
Cape Mudge Males; n = 508
Frequency (%)
Total length (cm)

Figure 3. Spiny dogfish length frequency by sex and location from the October 7-15, 2011 Strait of Georgia spiny dogfish longline survey.

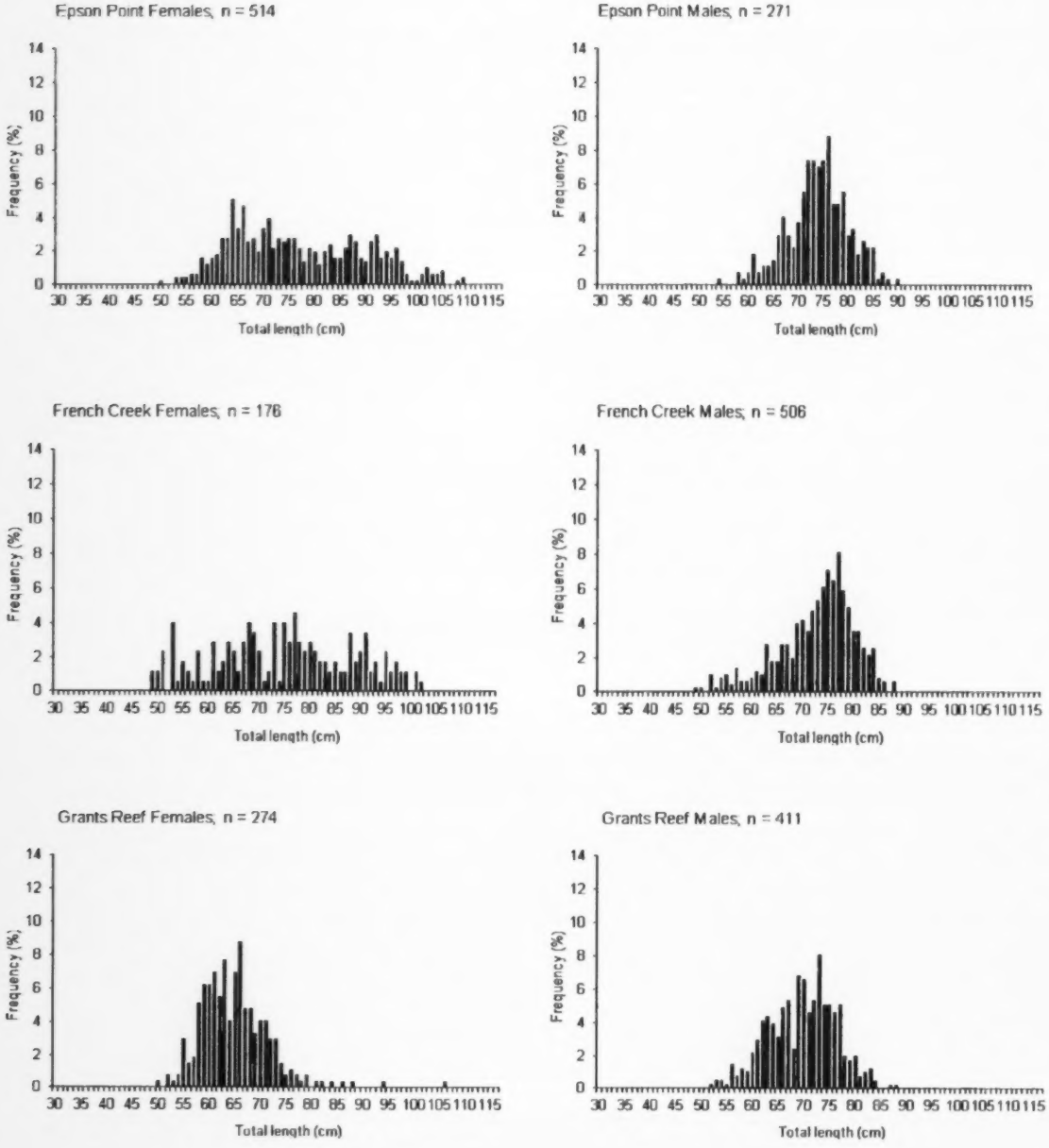

Epson Point Females, n = 514
Epson Point Males, n = 271
French Creek Females, n = 176
French Creek Males, n = 506
Grants Reef Females, n = 274
Grants Reef Males, n = 411
Frequency (%)
Total length (cm)

Figure 3 continued. Spiny dogfish length frequency by sex and location from the October 7-15, 2011 Strait of Georgia spiny dogfish longline survey.

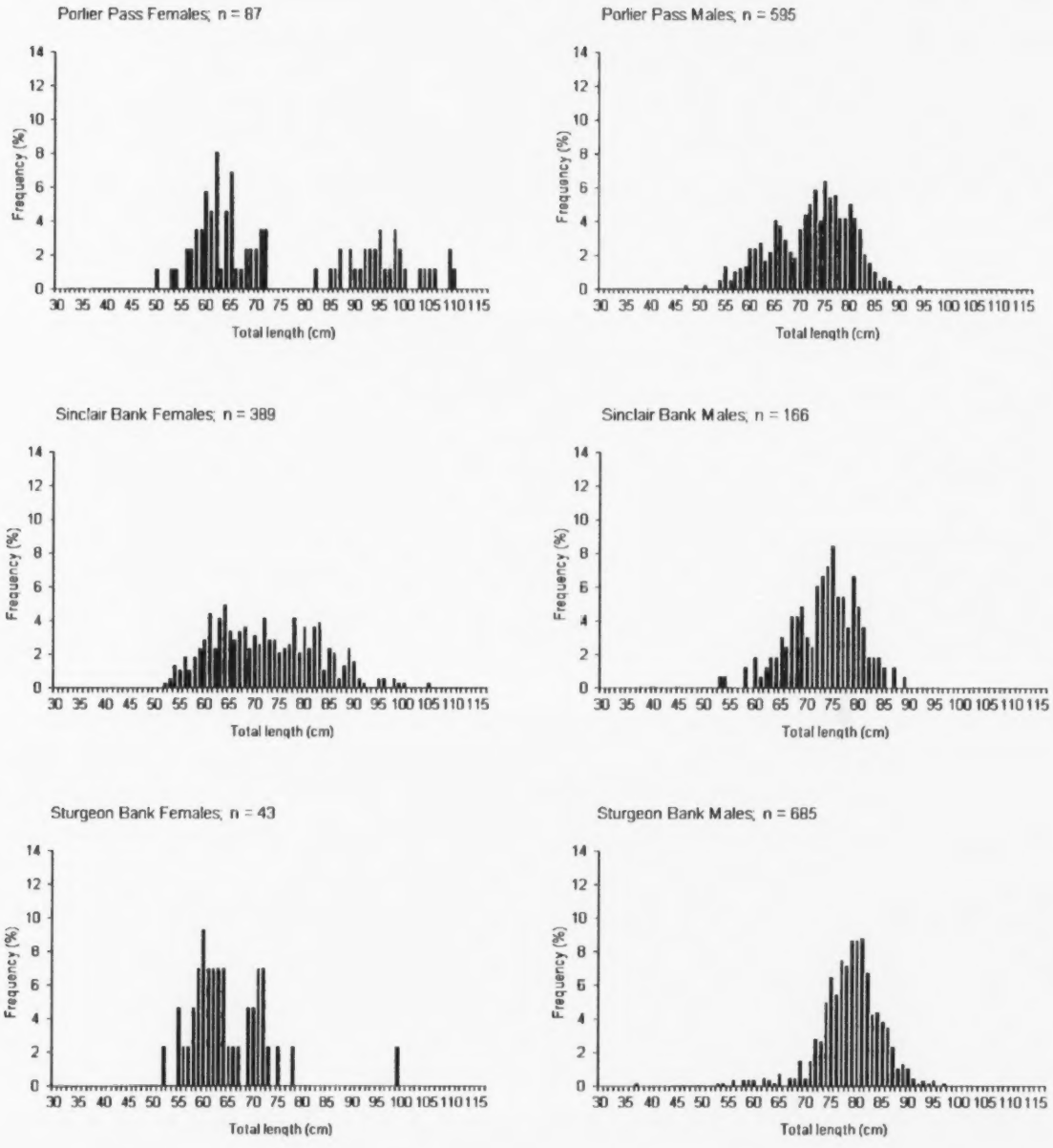
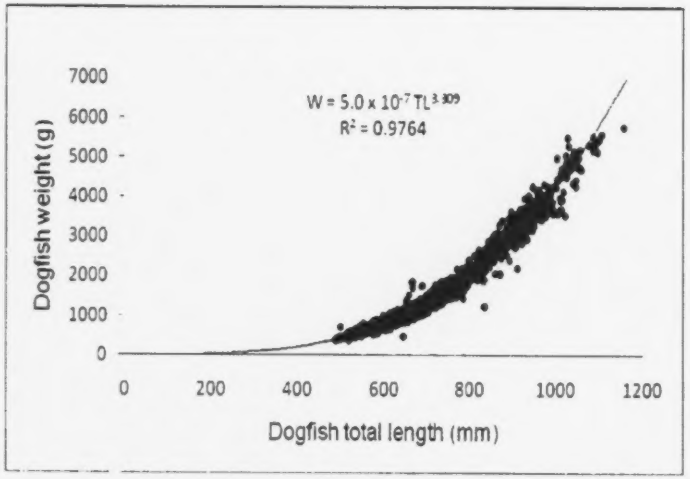

Porlier Pass Females; n = 87
Porlier Pass Males; n = 595
Sinclair Bank Females; n = 389
Sinclair Bank Males; n = 166
Sturgeon Bank Females; n = 43
Sturgeon Bank Males; n = 685
Frequency (%)
Total length (cm)

Figure 3 continued. Spiny dogfish length frequency by sex and location from the October 7-15, 2011 Strait of Georgia spiny dogfish longline survey.



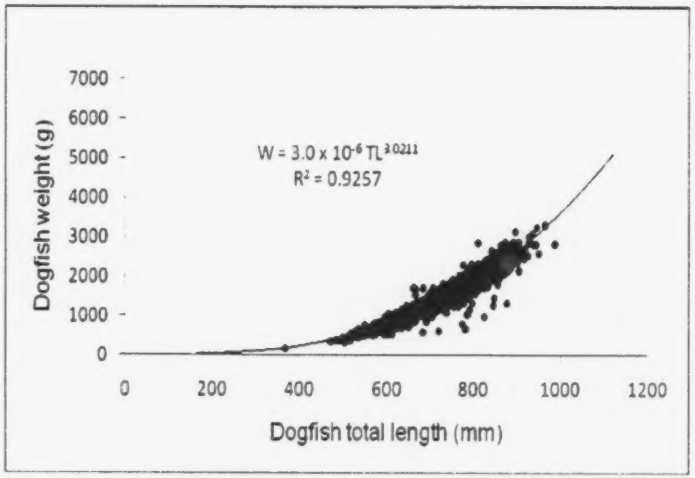


Figure 4. Relationship between weight (W) and total length (TL) for female and male spiny dogfish from the October 7-15, 2011 Strait of Georgia spiny dogfish longline survey. The equation for the regression lines is of the form $W = aTL^b$, and R^2 is the square of correlation coefficient.

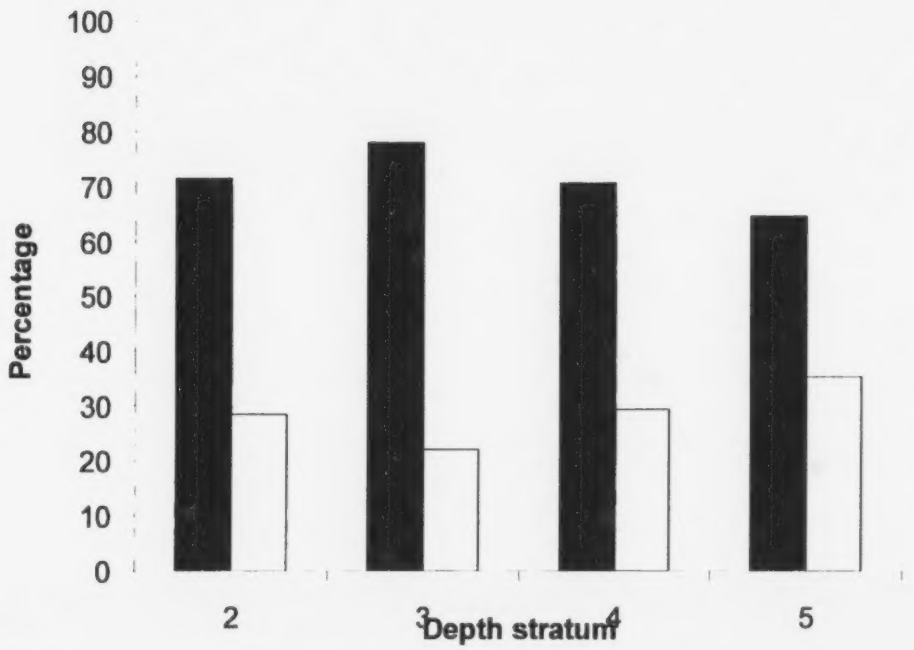


Figure 5. Spiny dogfish sex ratio by depth stratum (2: 56 to 110m, 3: 111 to 165m, 4: 166 to 220m and 5: deeper than 220m) from the October 7-15, 2011 Strait of Georgia spiny dogfish longline survey. Black bars are males; white bars are females.

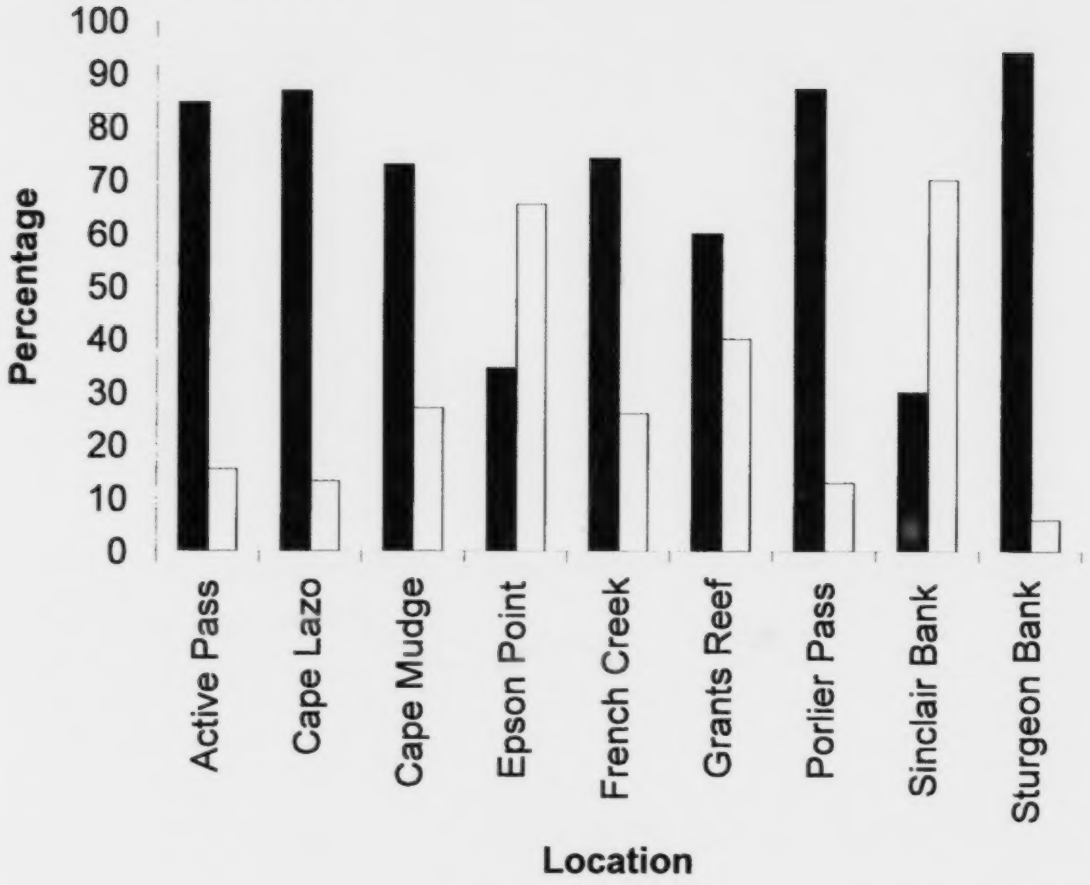


Figure 6. Spiny dogfish sex ratio by location from the October 7-15, 2011 Strait of Georgia spiny dogfish longline survey. Black bars are males; white bars are females.

Appendix 1. Bridge log from the October 5-17, 2011 spiny dogfish longline survey aboard the *CCGS Neocaligus*. Effective fishing time in minutes; all depths in meters; latitude and longitude in decimal degrees; distance in nautical miles; vessel speed in knots; direction in degrees true.

Date	Location	Set number	Depth stratum	Number of hooks	Start latitude	Start longitude	End latitude	End longitude	Start time	End time	Effective fishing time	Direction	Distance traveled	Vessel speed	Start depth	End depth
7-Oct-11	French Creek	1	5	300	49.23090	124.20142	49.22797	124.19396	7:38	10:24	166	130	0.55	2.7	236	241
7-Oct-11	French Creek	2	4	300	49.22507	124.19663	49.22299	124.18911	8:36	11:23	167	120	0.5	2.6	194	200
7-Oct-11	French Creek	3	3	300	49.23026	124.21480	49.22717	124.24771	12:42	15:28	166	130	0.5	2.5	136	142
7-Oct-11	French Creek	4	2	300	49.21620	124.20100	49.22034	124.20640	13:34	16:27	173	320	0.52	2.7	88	82
8-Oct-11	Sinclair Bank	5	5	300	49.41782	124.15235	49.41240	124.15184	8:13	11:14	181	175	0.5	2.7	238	237
8-Oct-11	Sinclair Bank	6	4	300	49.41648	124.17899	49.42180	124.18083	9:08	12:18	190	350	0.5	3	183	201
8-Oct-11	Sinclair Bank	7	2	300	49.41859	124.17049	49.42549	124.17148	13:12	15:59	167	355	0.7	3.5	97	87
8-Oct-11	Sinclair Bank		3	Not fished due to gale force winds.												
9-Oct-11	Cape Mudge	8	3	300	50.59025	125.06797	50.00028	125.07285	8:00	10:46	166	125	0.5	2.7	132	139
9-Oct-11	Cape Mudge	9	2	300	49.58879	125.06118	49.59353	125.06448	9:01	11:39	158	340	0.5	2.5	95	80
9-Oct-11	Cape Mudge	10	4	300	49.59423	125.05797	49.58910	125.05588	12:24	15:06	162	165	0.5	2.7	190	200
9-Oct-11	Cape Mudge	11	5	300	49.58938	125.05014	49.58412	125.05065	13:11	15:58	167	180		2.7	250	250
10-Oct-11	Grant Reef	12	2	300	49.52420	124.45000	49.51857	124.45172	7:49	10:28	159	190	0.6	2.5	80	93
10-Oct-11	Grant Reef	13	3	300	49.51044	124.43658	49.50485	124.43282	8:45	11:28	163	160	0.6	2.7	140	147
10-Oct-11	Grant Reef	14	4	300	49.49163	124.43951	49.49594	124.44541	12:19	15:05	166	320	0.6	2.6	183	180
10-Oct-11	Grant Reef	15	5	300	49.48186	124.44189	49.48530	124.44954	13:10	15:55	165	300	0.6	2.6	223	236
11-Oct-11	Cape Lazo	16	2	300	49.44587	124.50895	49.44111	124.50366	8:07	10:49	162	145	0.5	2.8	93	97
11-Oct-11	Cape Lazo	17	3	300	49.44459	124.49468	49.43976	124.48948	8:58	11:42	164	145	0.6	2.7	145	150
11-Oct-11	Cape Lazo	18	5	300	49.43422	124.47027	49.43949	124.47464	12:34	15:25	171	330	0.6	3	232	239
11-Oct-11	Cape Lazo	19	4	300	49.42692	124.46866	49.43169	124.47415	13:17	16:15	178	330	0.6	3	186	181
12-Oct-11	Epson Point	20	5	300	49.28770	124.03575	49.28457	124.02933	7:46	10:31	165	140	0.5	2.4	235	231
12-Oct-11	Epson Point	21	4	300	49.28436	124.02582	49.28053	124.01929	8:37	11:25	168	132	0.6	2.9	184	189
12-Oct-11	Epson Point	22	2	300	49.29213	124.02088	49.29807	124.02766	12:17	14:58	161	320	0.6	3	91	82
12-Oct-11	Epson Point	23	3	300	49.28733	124.01887	49.29213	124.02534	13:03	15:41	158	320	0.6	3	142	139
13-Oct-11	Porlier Pass	24	5	300	49.05444	123.34980	49.04999	123.34522	8:25	11:32	187	147	0.5	2.7	230	237
13-Oct-11	Porlier Pass	25	4	300	49.04711	123.36181	49.04193	123.35677	9:10	12:19	189	147	0.6	3	193	194
13-Oct-11	Porlier Pass	26	3	300	49.03817	123.35891	49.03239	123.35331	13:09	15:55	166	145	0.6	3	138	150
13-Oct-11	Porlier Pass	27	2	300	49.02998	123.35705	49.03503	123.36165	13:53	16:39	166	330	0.6	3	87	73
14-Oct-11	Active Pass	28	2	300	48.56371	123.25456	48.55985	123.24515	7:49	10:35	166	122	0.7	3.5	83	86
14-Oct-11	Active Pass	29	3	300	48.56580	123.24761	48.56107	123.23936	8:32	11:23	171	135	0.66	4	146	143

Appendix 1 continued. Bridge log from the October 7-15, 2011 spiny dogfish longline survey aboard the *CCGS Neocaligus*. Effective fishing time in minutes; all depths in meters; latitude and longitude in decimal degrees; distance in nautical miles; vessel speed in knots; direction in degrees true.

Date	Location	Set number	Depth stratum	Number of hooks	Start latitude	Start longitude	End latitude	End longitude	Start time	End time	Effective fishing time	Direction	Distance traveled	Vessel speed	Start depth	End depth
14-Oct-11	Active Pass	30	4	300	48.57567	123.24190	48.57127	123.23439	12:23	15:03	160	130	0.6	3	193	194
14-Oct-11	Active Pass	31	5	299	48.58290	123.23605	48.57839	123.22812	13:15	15:51	156	132	0.7	3	234	225
15-Oct-11	Sturgeon Bank	32	2	300	49.08396	123.18430	49.09061	123.18206	7:37	10:18	161	12	0.7	2.5	88	89
15-Oct-11	Sturgeon Bank	33	3	300	49.08717	123.19620	49.09381	123.19464	8:24	10:55	151	6	0.7	2.5	140	140
15-Oct-11	Sturgeon Bank	34	4	300	49.10810	123.20998	49.10153	123.20930	11:55	14:36	161	174	0.6	3	193	194
15-Oct-11	Sturgeon Bank	35	5	300	49.11034	123.22573	49.10384	123.22444	12:40	15:18	158	170	0.6	3	240	235